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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/609,387	07/03/2000	T. Frank Wang	8229-006-27	3989

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EXAMINER

DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 02/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/609,387

Applicant(s)

WANG, T. FRANK

Examiner

DuyVu n Deo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3, 5-7, 10-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Mu et al. (US 4,980,018).

Mu describes a method a semiconductor device comprising: providing a semiconductor device having several layers, at least on of the layers is a refractory metal-containing material such as W (col. 5, line 32-45); etching the semiconductor device with a first etchant having SF₆, Cl₂, He (claimed a chlorine source free of BCl₃ and a fluorine source) (col. 3, line 53-54) and a second etchant comprising Cl₂ and He (claimed etchant which is free of fluorine) (col. 4, line 5).

Referring to claim 12, the flow rates of Cl₂ is about 130 sccm and of He is 50 sccm (col. 8, line 29-32). This would make the Cl₂ concentration is about 72 %, which is within claimed 50-95%.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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4. Claims 13-18, 20-21, 24, 25, 29-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mu as applied to claims 1 above, and further in view of Tsang (US 4,713,141) and Kugimiya et al. (US 6,277,763).

Mu describes the process power (source power) is 250W. He doesn't describe the bias power is from 200-500W. He doesn't describe the bias power because he uses a commercially available single wafer etch (col. 6, line 18-20). However, at the time of the invention was made there are other commercially available etcher to etch refractory material including single wafer, parallel-plasma etcher, reactive ion etcher, plasma diodes or triodes etchers, magnetron etchers and other type of plasma etchers as disclosed here by Tsang (col. 2, line 67-col. 3, line 3, line 53-55). An example of commercially available etcher is DPS etcher (col. 2, line 59-61) as shown here by Kugimiya where he teaches the source and bias power are 100-1000W and 10-300W (col. 5, line 10-14). These processing parameters would overlap claimed processing parameters of source and bias power and their ratio. It would have been obvious at the time of the invention to one skill in the art that other etcher as shown above by Tsang and Kugimiya to etch the refractory metal with a reasonable expectation of success.

Mu's method shows the refractory metal is deposited above the oxide layer (col. 4, line 53-56) and the step of overetching (second etchant) would expose the under oxide layer and therefore would also remove some of the under oxide layer 13 (figure 3). This would read on claimed partially etching through the oxide layer with the second etchant.

5. Claims 4, 8, 19, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mu or Mu/Tsang/Kugimiya as applied to claims 1, 5, 15, 17 above.

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Even though Mu doesn't describe the refractory metal-containing comprise TiW alloy (claim 4). However, he describes that the method can be applied to etch other refractory metals, with minor adjustments in operating parameters (col. 5, line 42-45). Therefore, at the time of the invention, using the method to etch the TiW would have been obvious since W and TiW are used in manufacturing various semiconductor devices (please see page 1 of the specification) with a reasonable expectation of success.

Referring to claim 8, Mu doesn't describe the Cl₂ in the first chemistry is about 50-95%. However, he teaches that the processing parameters including flow rate may be varied and depending the material being etched (col. 5, line 41-45; col. 6, line 13-17). This would show that the parameters in the processing are result-effective variables. Therefore, at the time of the invention, it would have been obvious for one skill in the art to determine the optimum processing parameters including the flow rate or concentration of Cl₂ through routine experimentation in order to etch the refractory material with a reasonable expectation of success.

6. Claims 9, 23, 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mu or Mu/Tsang/Kugimiya as applied to claims 5, 15 above, and further in view of Roberts et al. (US 5,626,775).

Referring to claims 9, 23, 26-28, using other carrier gas such as N₂ is well known to one skill in the art in the art of etching semiconductor device. Roberts shows the carrier gas including He and N (col. 5, line 25-26). It would be obvious at the time of the invention, using any of those carrier gas would be equivalent to etch the refractory material with a reasonable expectation of success.

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Referring to the processing parameters such as the flow rates of the etching gases in the first and etchants. Mu teaches that the processing parameters including flow rate may be varied and depending the material being etched (col. 5, line 41-45; col. 6, line 13-17). This would show that the parameters in the processing are result-effective variables. Therefore, at the time of the invention, it would have been obvious for one skill in the art to determine the optimum processing parameters including the flow rate or concentration of Cl₂ through routine experimentation in order to etch the refractory material with a reasonable expectation of success.

Response to Arguments

7. Applicant's arguments with respect to claims 1-35 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-3:30; with alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DVD
2/23/04

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

